

Second Edition

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A First Course in Statistics

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On the cover: James Melchert's "Alternating Current #5," composed of glazed and fired ceramic tiles, measures 48 x 48 inches and was done in 1985. Melchert was the Director of the Visual Arts Foundation for the National Endowment for the Arts from 1977 until 1981. Presently on leave from the University of California, Berkeley, Melchert is the Director of the American Academy in Rome. His work may be seen at the Fuller Goldeen Gallery and the Museum of Modern Art in San Francisco.

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Consequently, we say that these test results are "very significant"; i.e., they disagree rather strongly with the null hypothesis, $H_0: \mu = 2,400$, and favor $H_a: \mu > 2,400$. The probability of observing a z -value as large as 2.12 is only .0170, if in fact the true value of μ is 2,400.

If you are inclined to select $\alpha = .05$ for this test, then you would reject the null hypothesis because the p -value for the test, .0170, is less than .05. In contrast, if you choose $\alpha = .01$ you would not reject the null hypothesis because the p -value for the test is larger than .01. Thus, the use of the observed significance level is identical to the test procedure described in the preceding sections except that the choice of α is left to you.

Definition 6.3

The *observed significance level, or p -value*, for a specific statistical test is the probability (assuming H_0 is true) of observing a value of the test statistic that is at least as contradictory to the null hypothesis, and supportive of the alternative hypothesis, as the one computed from the sample data.

Example 6.5 Find the observed significance level for the test of the mean weight of bran in cereal in Example 6.4

Solution Example 6.4 presented a two-tailed test of the hypothesis

$$H_0: \mu = 1.2 \text{ ounces}$$

against the alternative hypothesis

$$H_a: \mu \neq 1.2 \text{ ounces}$$

The observed value of the test statistic in Example 6.4 was $z = -2.09$, and any value of z less than -2.09 or larger than 2.09 (because this is a two-tailed test) would be even more contradictory to H_0 . Therefore, the observed significance level for the test is

$$p\text{-value} = P(z < -2.09 \text{ or } z > 2.09)$$

Consulting Table III in the Appendix, we find

$$P(z > 2.09) = .5 - .4817 = .0183$$

Therefore, the p -value for the test is

$$2(.0183) = .0366$$

These test results would be called significant *in a statistical sense*. Whether the results are significant *in a practical sense* depends on how much the actual mean weight of bran differs from the desired weight of 1.2 ounces and whether the difference is large enough to be of significance from an economic and nutritional point of view. ■

Exercises 6.36–6.48